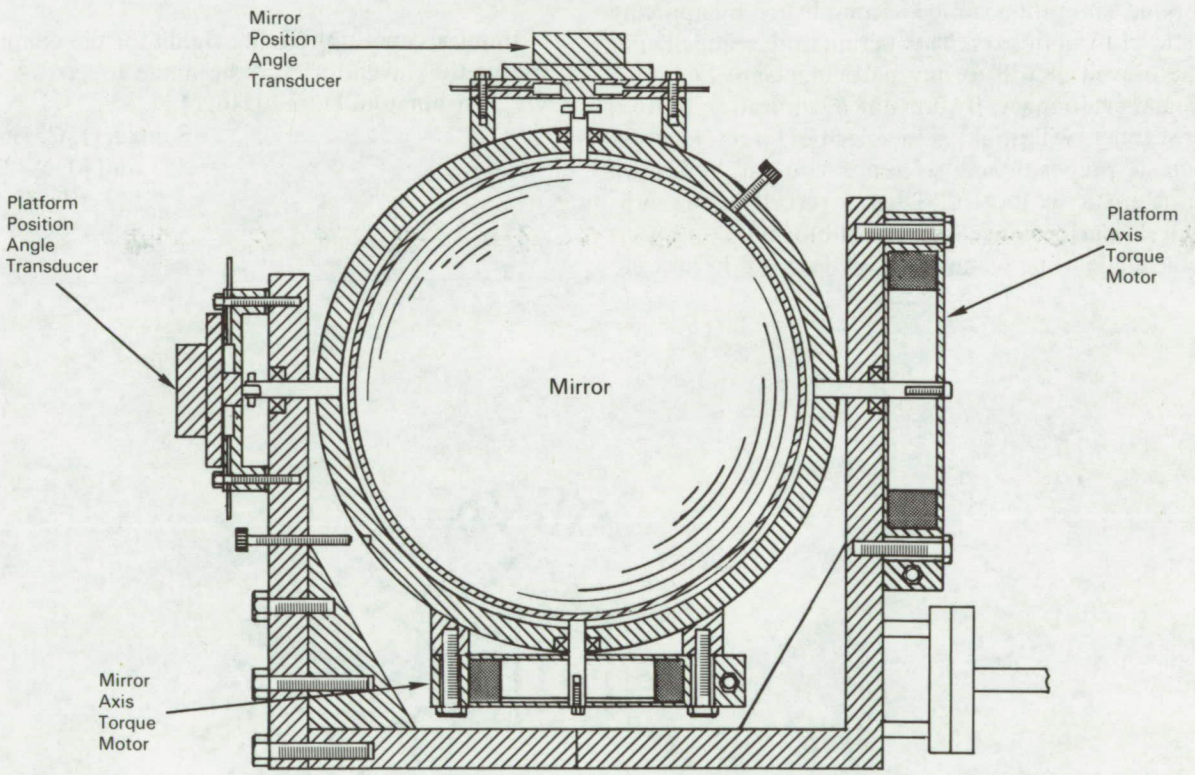
NASA TECH BRIEF

Gimbaled-Mirror Scanning System Capable of Spiral Pattern



The problem:

To design an infrared radiation scanning system, which would be efficient, flexible, and capable of remote positioning. Existing scanners, which use cam driven mirrors, can scan only in a raster pattern. Time is wasted in the return transition for each line, and there is no easy way to change the pattern or speed of the scan cycle. Furthermore, these assemblies are large and heavy because the motor-gear-mirror system is mounted as an integral part of the radiometer optical head.

The solution:

A new gimbaled-mirror scanner, with a lightweight torque motor direct coupled to each axis, is capable of scanning in a highly efficient spiral pattern. This pattern can be easily altered if desired. In addition, the scanner is lightweight and can be remotely positioned in previously inaccessible areas because the radiometer head and the gimbaled-mirror scanner can be separated.

How it's done:

The gimbaled-mirror scanner has electrical components only recently available. These permit a mirror

(continued overleaf)

or platform positioning capability that was previously impractical. Actual mirror position is sensed by an angle transducer whose output is compared to an input signal which is supplied externally. Error signals are amplified and applied in a servo loop to the torque motors, which then move to correct the error. Thus, the mirror can be made to scan in any desired manner by supplying the appropriate electrical signals to the servo control system.

By providing a sine wave to one axis, and a cosine wave to the other, with both signals increasing in amplitude from zero, the mirror will scan in a spiral pattern. This provides a smooth continuous motion which is faster and more efficient than the patterns of previous scanners. A raster pattern can also be obtained by providing a step function to one axis and a ramp function to the other.

In-line calibration can be accomplished by applying a dc level to both axes. This permits the scanned spot to be moved at will to any particular spot and then to remain stationary. By pressing a calibration button, the scanner will look at a specific target location where a prepositioned reference coupon of known characteristics is located. Thus, a record of the radiometer's performance under calibration conditions can be made while scanning operations are in process.

Notes:

1. The flexibility of the improved scanner permits its use in other tasks besides scanning. A single source of radiation (monochromatic light from a precision source, infrared, or ultraviolet) can be accurately directed at any number of sensors in turn. The need for multiple radiation sources or complicated reflecting systems can be eliminated.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B67-10609

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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